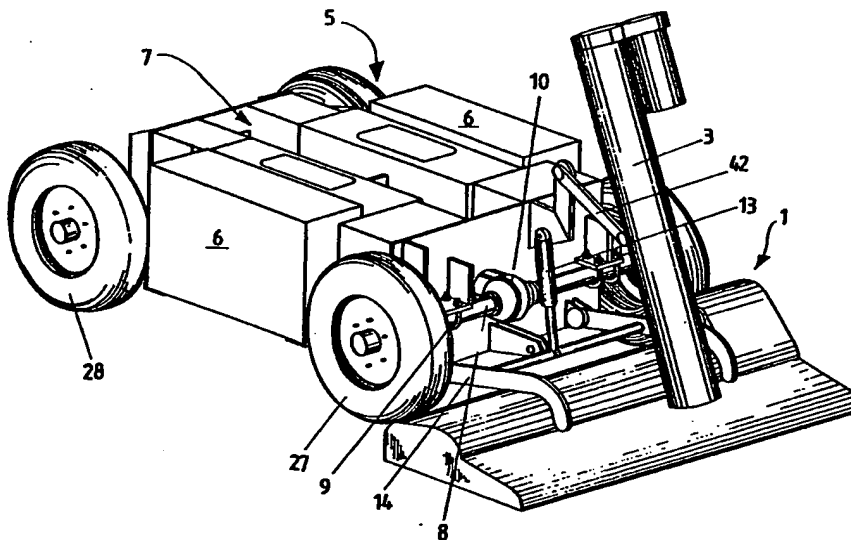




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(54) Title: ICE RINK RESURFACING MACHINE



(57) Abstract

The object of the invention is an ice-maintenance machine, which includes a steerable vehicle (2), a water tank (15, 16), a platform (4) for icy slush, an ice-maintenance unit (1) propelled by the vehicle, and a removal conveyor (3) for transferring the icy slush from the ice machining unit (1) to the platform (4) and in which the vehicle (2) includes a chassis (5), front and rear axles (8, 11) with wheels (27, 28), a motor (24), and transmission devices connected to the axles including a cardan axle (22) between them and a distribution gearbox (23). A low structure is achieved when the chassis (5) is formed of a box structure, which itself forms the water tank (15, 16), and that the centre of the chassis includes a longitudinal channel (7) for the cardan axle (22) and the distribution gearbox (23).

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ICE RINK RESURFACING MACHINE.

The object of the invention is an ice-maintenance machine, which includes a steerable vehicle, a water tank, a platform for icy slush, an ice-maintenance unit propelled by the vehicle, and a removal conveyor for transferring the icy slush from the ice machining unit to the platform, and in which the vehicle includes a chassis, front and rear axles with wheels, a motor, and transmission devices connected to the axles including a cardan axle between them and a distribution gearbox.

Ice-maintenance machines are presented in US patent publications numbers 3,044,193, 3,622,205, and 3,705,746. Nearly all present ice-maintenance machines utilize a combustion motor-driven vehicle, which is constructed on a separate beam chassis, which carries a separate water tank, a platform for icy slush, and a motor and transmission. The construction reaches a considerable height, which is not advantageous from the point of view of the operability of the device.

The intention of this invention is to create a new kind of ice-maintenance machine, which makes possible a lower total structure than previously. The characteristic features of an ice-maintenance machine in accordance with the invention are presented in the accompanying Patent Claims. When the chassis is formed by a box construction, and the transmission is adapted to the same level as the chassis, there is a considerable saving in overall height, when at the same time the box construction forms the water tank required by the ice-maintenance machine. The transmission channel can naturally also be a tunnel-like space, but an open channel is more advantageous from the point of view of installation and maintenance.

Other forms of application and advantages of the invention become apparent later in connection with the example of execution.

In what follows the invention is illustrated by reference to the accompanying Figures, which show one ice-maintenance machine in accordance with the invention and its chassis construction together with the transmission.

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Figure 1 shows the ice-maintenance machine seen from the side.

Figure 2 shows the ice-maintenance machine seen from above.

10 Figure 3 shows an axonometric view of the chassis of the ice-maintenance machine, the transmission, and the ice-maintenance unit.

Figure 4 shows the chassis and transmission of the ice-maintenance machine seen from the side and in-cross-section at the transmission channel.

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Figure 5 shows the chassis and transmission seen from above.

In accordance with Figures 1 and 2 the ice-maintenance machine includes a steerable vehicle 2, to which an ice-maintenance unit 1 is attached by means of carrier arm 14. The vehicle 2 includes chassis 5, battery bank 6, and snow platform 4, which in normal operation is covered by cover 26. The ice-machining unit 1 is connected to the opening of the snow reservoir 4 by means of a removal conveyor 3 in what is as such a known method. The cab 25 of the vehicle includes the control devices for the ice-machining unit 1. Due to the traction resistance of the ice-machining unit 1, both the front and rear wheels 27 and 28 of the steerable vehicle 2 are driven, while the front wheels 28 turn in a manner that is in itself known. It is advantageous if the vehicle is electrically powered, when the exhaust emissions of a combustion motor are avoided. Because the operating area is very limited, it is possible to use electrical supply by means of a 3-phase cable, either as an alternative to the above-mentioned battery bank, or in addition to it.

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Figure 3 shows the basic construction of the device schematically, without the platform, cab, or cover. The box chassis 5 is

shown later in greater detail, but Figure 3 shows the channel 7 is the centre of the chassis, in which the cardan axle between the axles and the rest of the transmission is located. The ice-maintenance unit 1 is suspended from the chassis by means of arms 14 and is pressed against the ice by means of cylinder 13. Removal conveyor 3, which is supported from the chassis by means of arm 42, is used to transfer the icy slush from the ice-maintenance unit 1 to the platform. Figure 3 shows the rigid attachment of the rear axle 8 to the chassis. Both axles, as in this case the rear axle 8, have a bevel gearbox 10, equipped with a differential gear, rigidly attached to them.

The front axle, which includes a turning mechanism, is suspended by means of swing bracket 19, which is in turn jointed to chassis 5 by means of longitudinal axle 20. By means of this, the vehicle is able to absorb small unevennesses, such as thresholds, etc.. The rear axle 8 is attached to the chassis flanges by U-bolts 9 and the front axle 11 correspondingly to the swing bracket 19 by U-bolts 21.

The box construction of chassis 5 consists of two side boxes 15 and of a narrower connecting box 16 between them beneath the transmission channel 7. In addition, the six boxes 15 have common end plates 17 and 18, in which operational openings, for among other things bevel gears 10 and 12, are formed next to the channel 7.

Flanges 37, 38, and 39 are welded onto the end plates 7 of chassis 5 in order to carry the ice-maintenance unit and other auxilliary equipment. In addition, the end plates include flanges for the rear axle and the jointing of the platform.

The motor 24 and the distribution gearbox 23 are also advantageously placed in the transmission channel 7. The motor 24 is supported on a flange welded to the chassis, but the distribution gearbox 23 is supported directly by the bevel gearbox 10 belonging to the rear axle 8. After this only a moment support from the distribution gearbox is required to the

chassis 5. The distribution gearbox 23 and the motor 24 are connected by jointed axle 29 and the distribution gearbox 23 is connected to the bevel gear 12 of the front axle 11 by means of jointed arm 22. In addition the transmission includes motor
5 revolution speed sensor devices and a parking brake, which are not separately shown here.

Figure 5 shows the chassis structure without the battery bank. The battery bank is suspended from supports 32, which are welded
10 to the sides of the frame. The front axle 11 includes intermediate arm 29, which is operated by a hydraulic cylinder from a protrusion arranged on the right-hand side of the swing bracket. A schematic intermediate arm 29 and a hydraulic
cylinder 30 for operating it are drawn in Figure 4.

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The water tank includes maintenance manholes 33, a filler pipe 35, a replacement air pipe 36, and a drainpipe 34 (in Figure 4). Inside the water tank it is advantageous to use a submersion pump, which is not separately shown here.

Patent Claims

1. An ice-maintenance machine, which includes a steerable vehicle (2), a water tank (15, 16), a platform (4) for icy slush, an ice-maintenance unit (1) propelled by the vehicle, and a removal conveyor (3) for transferring the icy slush from the ice machining unit (1) to the platform (4), and in which the vehicle (2) includes a chassis (5), front and rear axles (8, 11) with wheels (27, 28), a motor (24), and transmission devices connected to the axles including a cardan axle (22) between them and a distribution gearbox (23), characterized in that
- the chassis (5) is formed of a box structure, which itself forms the water tank (15, 16), and that
 - the centre of the chassis includes a longitudinal channel (7) for the cardan axle (22) and the distribution gearbox (23).
2. An ice-maintenance machine in accordance with Patent Claim 1, characterized in that the motor (24) is an electric motor, which is located on top of the cardan axle (22) in the same channel (7).
3. An ice-maintenance machine in accordance with Patent Claim 2, characterized in that the battery bank (6) is located equally on both sides of the chassis (5).
4. An ice-maintenance machine in accordance with Patent Claim 1, characterized in that the transmission devices include bevel gears (10, 12) equipped with differential gearing between the cardan axle and the axles (8, 11).
5. An ice-maintenance machine in accordance with Patent Claim 4, characterized in that one axle (8) with its bevel gears (10, 12) is rigidly attached to the chassis (5) and the opposite axle (11) is suspended by means of a swing bracket (19), which is jointed through a longitudinal axle (20) to the chassis (5).

6. An ice-maintenance machine is accordance with Patent Claim 5, characterized in that the bevel gearbox (10) of the rigidly attached axle (8) is arranged to carry the distribution gearbox (23), which is only supported by the chassis (5) is
5 order to cancel torque.

7. An ice-maintenance machine in accordance with any of Patent Claims 1 - 6, characterized in that the chassis (5) consists of two unified side boxes (15), a connecting box (16)
10 between them beneath the transmission channel (7), common end plates (17, 18) at the front and rear also covering the area of the transmission channel (7) except for operational openings.

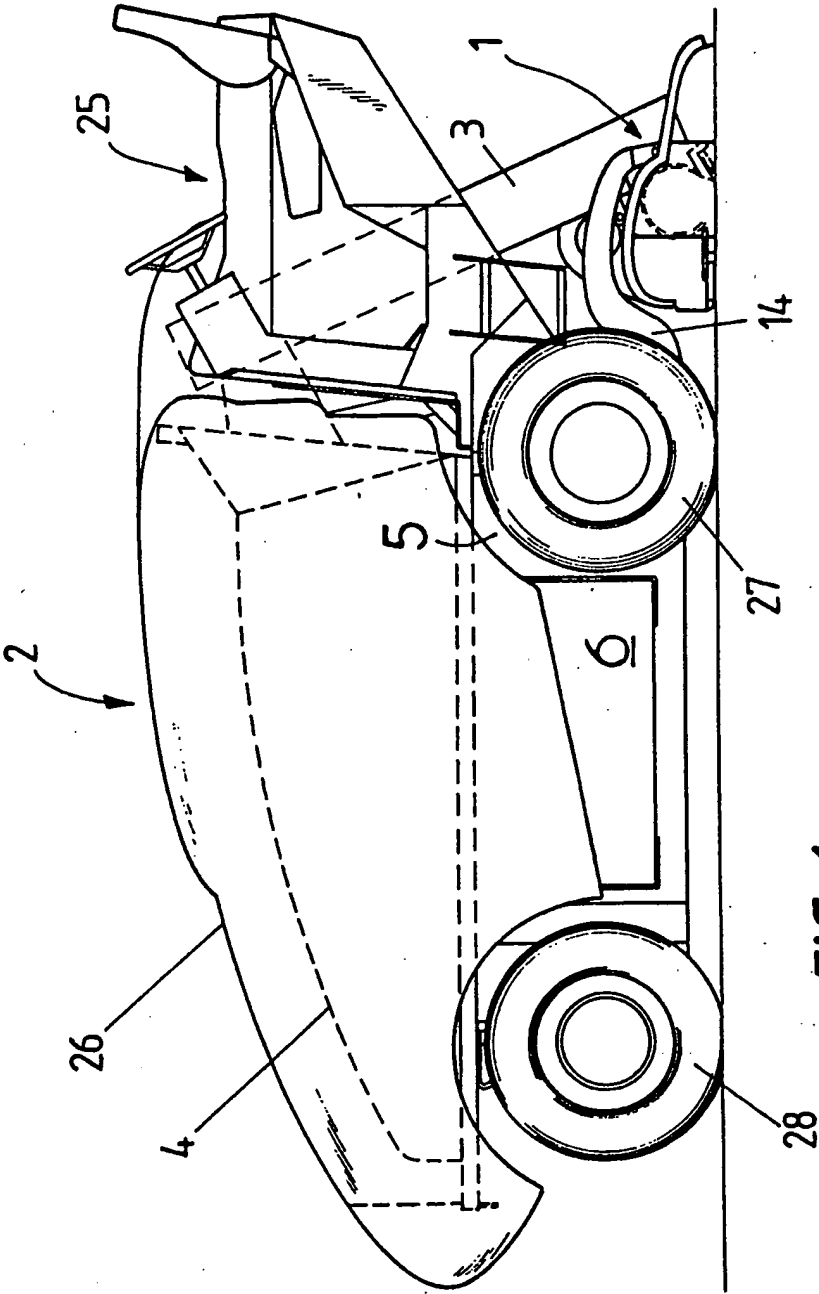


FIG. 1

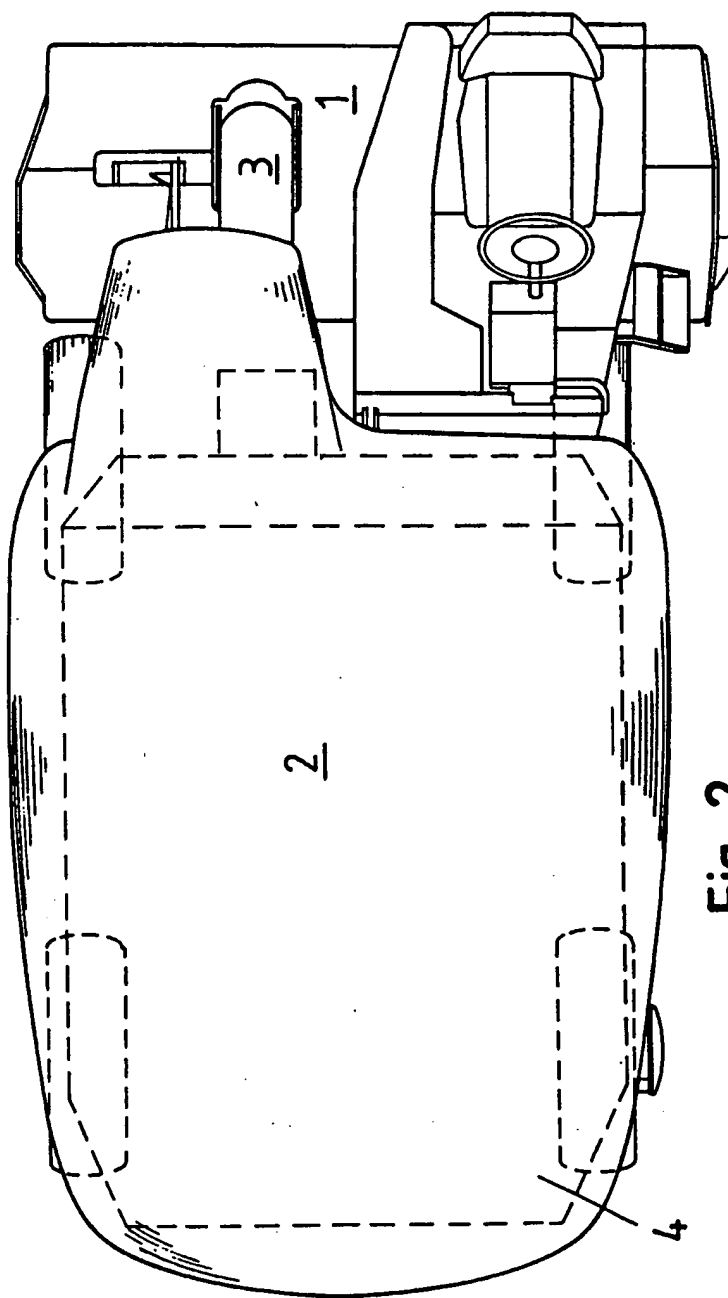


Fig. 2

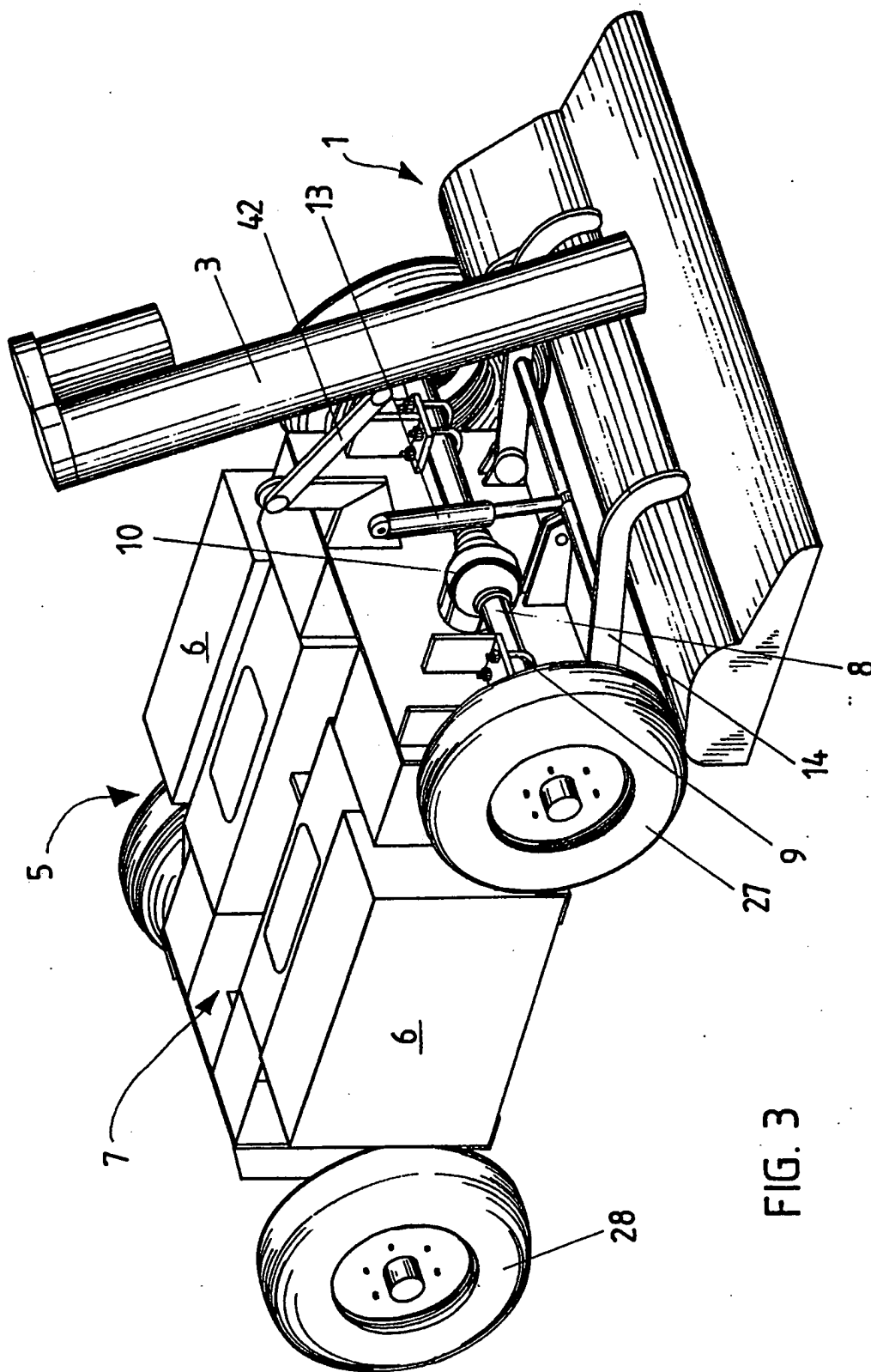


FIG. 3

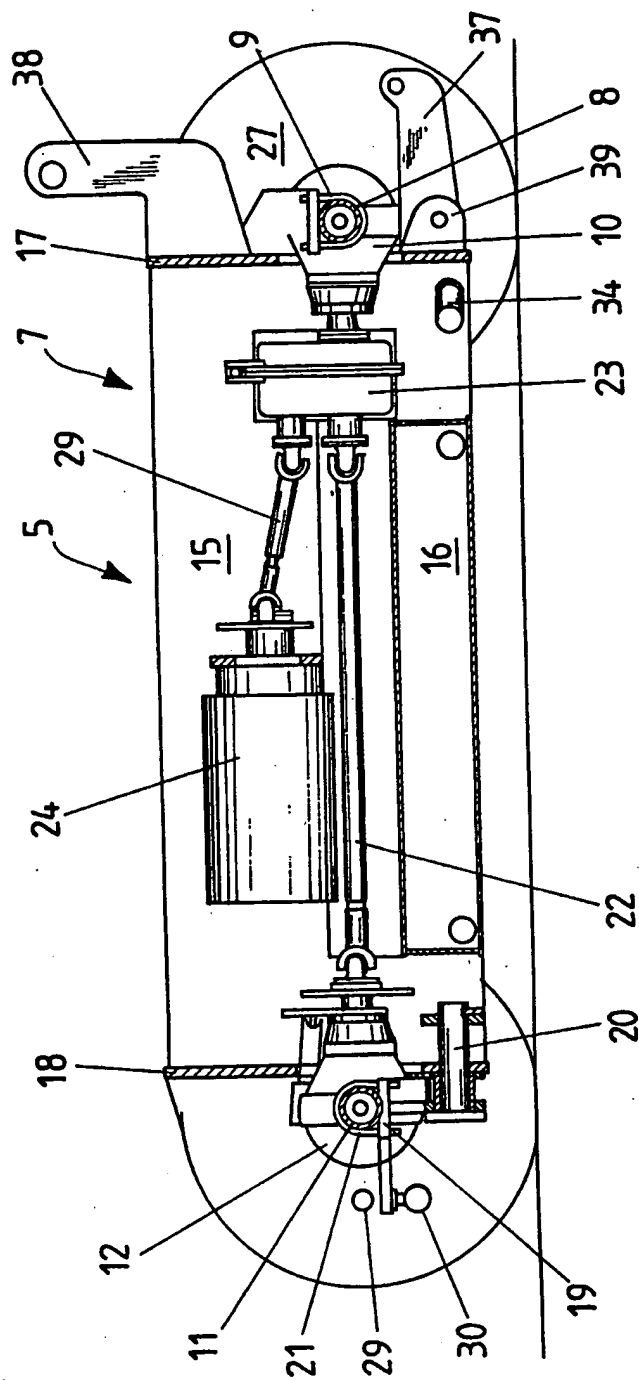


FIG. 4

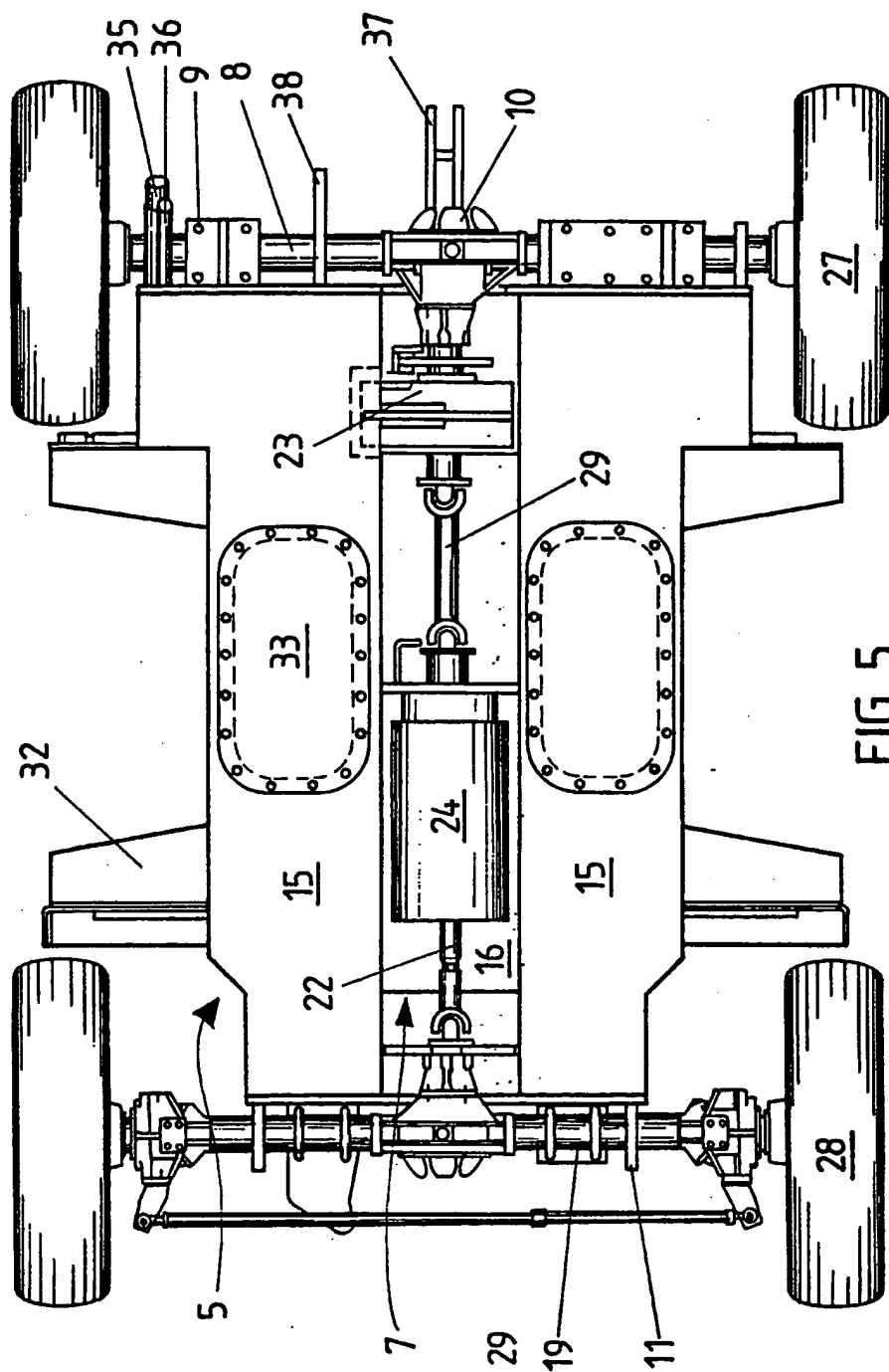


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 93/00441

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: E01H 4/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: E01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 2642679 (F.J. ZAMBONI), 23 June 1953 (23.06.53), the whole document --	1-7
A	US, A, 3622205 (F.J. ZAMBONI), 23 November 1971 (23.11.71), the whole document --	1-7
A	US, A, 3705746 (S.R. MCLEOD), 12 December 1972 (12.12.72), the whole document -----	1-7

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

21 January 1994

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INTERNATIONAL SEARCH REPORT

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US-A- 3622205	23/11/71	DE-A- 2130563 FR-A- 2097992 SE-B,C- 387247	20/01/72 03/03/72 06/09/76
US-A- 3705746	12/12/72	CA-A- 926117	15/05/73